

CLAIMS

What is claimed is:

1. An apparatus comprising:
 - a printed circuit board (PCB) having a top surface and a bottom surface;
 - a bottom heat dissipating device attached to the bottom surface of the PCB, a top surface of the bottom heat dissipating device thermally coupled with a backside surface of one or more electronic components mounted on the bottom surface of the PCB;
 - a top heat dissipating device attached to the top surface of the PCB; and
 - a thermally conductive coupling member thermally coupled with the bottom and top heat dissipating devices.
2. The apparatus of claim 1, wherein the apparatus is a mezzanine card.
3. The apparatus of claim 2, wherein the top and bottom heat dissipating devices are heat spreaders having a length between 100 and 140 millimeters.
4. The apparatus of claim 3, wherein a height from a bottom surface of the bottom heat spreader to a top surface of the top heat spreader is 8.2 millimeters or less.
5. The apparatus of claim 2, wherein the mezzanine card is in accordance with an IEEE 1386 standard.
6. The apparatus of claim 3, wherein the one or more electronic components mounted on the bottom surface of the PCB comprise a processor.

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1 7. The apparatus of claim 6, wherein the thermally conductive coupling member
2 extends along an edge portion of the PCB, and the processor is mounted within 3
3 millimeters from said edge portion.

1 8. The apparatus of claim 1, wherein the thermally conductive coupling member
2 comprises a top portion and a bottom portion, wherein the top portion is integral with
3 the top heat dissipating device and/or the bottom portion is integral with the bottom
4 heat dissipating device.

1 9. The apparatus of claim 1, further comprising at least one other thermally
2 conductive coupling member thermally coupled with the bottom and top heat
3 dissipating devices.

1 10. The apparatus of claim 1, wherein the bottom heat dissipating device and/or the
2 top heat dissipating device are made substantially of copper or a copper alloy.

1 11. The apparatus of claim 1, wherein a bottom surface of the top heat dissipating
2 device is thermally coupled with one or more electronic devices mounted on the top
3 surface of the PCB.

1 12. The apparatus of claim 1, wherein the top and bottom heat dissipating devices
2 are attached to the PCB with thermally conductive mounting hardware, said mounting
3 hardware thermally coupled with the top and bottom heat dissipating devices.

1 13. The apparatus of claim 12, wherein the thermally conductive mounting
2 hardware comprises one or more screws.

1 14. The apparatus of claim 1, wherein the bottom heat dissipating device and/or the
2 top heat dissipating device have recessed areas of different depths to thermally couple
3 with electronic components of different heights.

1 15. The apparatus of claim 1, wherein the thermally conductive coupling member
2 extends along an edge of the PCB by at least one opening formed adjacent a side edge
3 of the thermally conductive coupling member between the top and bottom heat
4 dissipating devices.

1 16. The apparatus of claim 15, wherein lengths of the top and bottom heat
2 dissipating devices extending along the edge of the PCB are between 100 and 140
3 millimeters and a length of the thermally conductive coupling member extending along
4 the edge is between 25 and 50 millimeters.

1 17. The apparatus of claim 15, wherein one or more dimensions of the thermally
2 conductive coupling member are optimized for cooling the PCB by conduction and
3 convection.

1 18. The apparatus of claim 1, wherein the thermally conductive coupling member
2 extends along an edge of the PCB with at least one opening formed within the
3 thermally conductive coupling member.

1 19. A system comprising:
2 a carrier board having a bus; and
3 a mezzanine card mounted on the carrier board coupled with the bus, the
4 mezzanine card comprising a printed circuit board (PCB), a bottom heat dissipating

device attached to a bottom surface of the PCB facing the carrier board, a top surface of the bottom heat dissipating device thermally coupled with a backside surface of one or more electronic components mounted on the bottom surface of the PCB, a top heat dissipating device attached to a top surface of the PCB, and a thermally conductive coupling member thermally coupled with the bottom and top heat dissipating devices.

20. The system of claim 19, wherein the top and bottom heat dissipating devices are heat spreaders having a length between 100 and 140 millimeters.

21. The system of claim 19, wherein a height from a top surface of the carrier board to a top surface of the top heat dissipating device is 13.5 millimeters or less.

22. The system of claim 21, wherein the mezzanine card is in accordance with an IEEE 1386 standard.

23. The system of claim 19, wherein the bottom heat dissipating device and/or the top heat dissipating device have recessed areas of different depths to thermally couple with electronic components of different heights.

24. The system of claim 19, wherein the top and bottom heat dissipating devices are attached to the PCB with thermally conductive mounting hardware also used to mount the mezzanine card to the carrier board, said mounting hardware thermally coupled with the top and bottom heat dissipating devices.

25. The system of claim 19, wherein the thermally conductive coupling member extends along an edge of the PCB with at least one opening formed adjacent the

3 thermally conductive coupling member between the top and bottom heat dissipating
4 devices.

1 26. The system of claim 25, wherein lengths of the top and bottom heat dissipating
2 devices extending along the edge of the PCB are between 100 and 140 millimeters and
3 a length of the thermally conductive coupling member extending along the edge is
4 between 25 and 50 millimeters.

1 27. A method to remove heat from a printed circuit board (PCB) comprising:
2 attaching a bottom heat dissipating device to a bottom surface of the PCB, a top
3 surface of the bottom heat dissipating device thermally coupled with a backside surface
4 of one or more electronic devices mounted on the bottom surface of the PCB;
5 attaching a top heat dissipating device to a top surface of the PCB; and
6 thermally coupling the top heat dissipating device with the bottom heat
7 dissipating device through a thermally conductive coupling member.

1 28. The method of claim 27, wherein thermally coupling the top heat dissipating
2 device with the bottom heat dissipating device with the thermally conductive coupling
3 member comprises forming an opening adjacent to at least one side edge of the
4 thermally conductive coupling member to allow air flow between the top and bottom
5 heat dissipating devices.

1 29. The method of claim 27, wherein the PCB is a PCB of a mezzanine card.

1 30. The method of claim 29, comprising optimizing one or more dimensions of the
2 thermally conductive coupling member for cooling the mezzanine card by conduction
3 and convection.